NOTES ON ASIATIC-POLYNESIAN-AUSTRALIAN SPECIES OF ERYTHRINA, II

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MY FIRST PAPER on this subject was published in 1939 (Preliminary Notes on Asiatic-Polynesian Species of *Erythrina*. Jour. Arnold Arb. 20: 225–233. 1939) without the benefit of having studied specimens in European and Asiatic herbaria because of the war. Previously there was no compact treatment of the Asiatic-Polynesian-Australian species. Since that time I have examined specimens in several major European herbaria (BM, BR, E, G, K, L, P, S, U, Z) and as a result have made considerable progress in the understanding of several species. Six species (namely *E. glauca* Willdenow, *E. boninensis* Tuyama, *E. phlebocarpa* F. M. Bailey, *E. rostrata* Ridley, *E. sandwicensis* Degener, and *E. stipitata* Merrill) are here reduced to synonymy for the first time.

A conspectus of the species of *Erythrina* worldwide is in the course of preparation; in it I plan to give complete synonymy and type localities of valid species and synonyms, cite the type collections, give carefully compiled distribution, and discuss habit and habitat. In the present paper I am giving largely the information which I consider important or interesting and which it is not possible to include in the conspectus. Complete synonymy is given only for *E. variegata* L., but I am citing, of course, under other species those which are reduced to synonymy for the first time. Specimens are cited only for *E. microcarpa* Koorders & Valeton, *E. euodiphylla* Hasskarl, *E. merrilliana* Krukoff, and *E. insularis* F. M. Bailey which are very poorly represented in herbaria.

Of 13 species reviewed in this paper the chromosome numbers were published for seven (Phytologia 19: 162, 163. 1969; Taxon 18(3): 314. 1969; and Ann. Missouri Bot. Gard. 56: 474. 1969). No counts have been published for *Erythrina microcarpa*, *E. resupinata*, *E. euodiphylla*, *E. merrilliana*, and *E. insularis*. A $2n$ number of 42 chromosomes was found in all Asiatic-Polynesian-Australian species sampled.

Three of the arboreous species under review (namely *E. arborescens*, *E. suberosa*, and *E. stricta*) and the herbaceous *E. resupinata* probably will prove to be frost tolerant in the Los Angeles area. It is kept in mind that by a formal proclamation on March 7, 1966, *Erythrina* was selected as the "Los Angeles official tree." *E. resupinata* will doubtless prove to be an excellent addition to rock gardens.

I wish to express obligation to Prof. Dr. C. G. G. J. van Steenis for his suggestions and help in obtaining certain critical type material. I am es-

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pecially indebted to Mr. R. Barneby for his assistance during the progress of this work, and for his cooperation in reading the manuscript.

KEY TO THE SPECIES [2]

1. Keel petals connate; seeds not red; rachises, pedicels, and leaflets (at least on petiolules and costa beneath) not stellate pubescent.
   2. *Standard long–stipitate, subrotund–rhombic*; pods ligneous; seeds opaque, umber to blackish with black markings. ..... 1. *E. fusca.*
   2. Standard and seeds not as above; pods follicular chartaceous (except in *E. arborescens*).
   3. Keel petals subequal to wings; *pods seedless and indehiscent in the lower half.* ..... 2. *E. subumbrans.*
   3. Keel petals conspicuously longer than wings; pods bearing seeds throughout.
      4. Plants native to Java. ..... 5. *E. microcarpa.*
      4. Plants not native to Java.
         5. *Perennial herbs with thickened roots* endemic to northern India. ..... 7. *E. resupinata.*
         5. Large trees.
            6. Pods ligneous; seeds shiny black; leaflets not ceriferous beneath; keel petals 1 1/3–2 times longer than wings. ..... 3. *E. arborescens.*
            6. Pods follicular, chartaceous; seeds isabelline to dark brown or sooty; leaflets ceriferous on both margins of veinlets beneath or intricately ceriferous beneath; keel petals 2 1/2 or more times longer than wings.
               7. Calyx campanulate; branchlets without numerous white spines when fresh. ..... 4. *E. suberosa.*
               7. Calyx subspathaceous; *branchlets heavily armed with white spines* when fresh. ..... 6. *E. stricta.*

1. Keel petals separate and subequal to wings (flowers of *E. insularis* not known); seeds scarlet-red or brownish red; rachises, pedicels, and leaflets (at least on petiolules and costa beneath) stellate pubescent.
   8. Seeds large (± 19 mm. long and ± 11 mm. broad), brownish red; pods with prominent veining; standard red. ..... 8. *E. variegata.*
   8. Seeds and pods not as above. Species keyed by geographic areas 9a, 9b, etc.

9a. Endemic to New Guinea; seeds scarlet with black hilum and with a black line extending from the hilum for approximately 2 mm. toward the chalazal end, 9–10 mm. long and 6–7 mm. broad; standard bright orange. ..... 11. *E. merrilliana.*

9b. Endemic to Australia.
   10. Seeds scarlet with white hilum, uniformly red, ± 13 mm. long and ± 7 mm. broad. ..... 13. *E. vespertilio.*
   10. Seeds scarlet with black hilum and with a black line extending from the hilum for approximately 2 mm. toward the chalazal end; 9.5–11 mm. long and 7–8 mm. broad; known only from the type collection from Turtle Island. ..... 12. *E. insularis.*

[2] Characters indicated by italics do not occur in other species.

9c. Endemic to Tahiti and Hawaii; standard orange; seeds ± 17 mm. long and 8 mm. broad. ..... 9. *E. tahitensis.*
9d. Endemic to Java; *all petals green; leaves fetid when fading.* .... 10. *E. euodiphylla.*

1. **Erythrina fusca** Loureiro, Fl. Cochinchinensis 427. 1790.

Erythrina glauca Willdenow, Ges. Nat. Freunde Berlin Neue Schr. 3: 428. 1801.

This species is a very large tree that thrives in a variety of conditions, but seems to prefer lowlands (seashores, swamps without outlets, low overflow lands, river banks, shores of lakes, etc.). In low swampy grounds where *Erythrina fusca* reaches especially huge dimensions, it often occurs in pure stands.

This is the most widespread species in the genus and the only one which occurs on three continents. It is undoubtedly dispersed by ocean currents.

In the Old World *Erythrina fusca* is found in a very extensive area, from Madagascar and the Mascarene Islands in the west; India, Burma, the Philippines and Carolines in the north; Samoa and Tonga Islands in the east; and New Caledonia, Papua, and Timor in the south.

In the New World it is found in the West Indies and on the Continent from Belize and Guatemala in the north to and including Peruvian, Brazilian, and Bolivian Amazonia in the south.

I did not place *Erythrina glauca* in synonymy in my monograph of the American species (Brittonia 3: 205–337. 1939) since before doing this I wanted to see *E. fusca*, as it appears in the Old World, in the field. There are no differences between *E. fusca* as it occurs in Asia, Polynesia, and Africa and as it is represented in the New World, in fact even its habitat is the same. According to a private communication from Prof. E. A. Bell and John Romeo of the University of Texas at Austin the alkaloids and amino acid patterns of seeds of this species, as it is represented in America and Asia, are very similar.

2. **Erythrina subumbrans** (Hasskarl) Merrill in Philip. Jour. Sci. Bot. 5: 113. 1910.

Plants of this species are medium size trees confined to low and middle elevations in light forests, open places, and secondary forests.

The species is found from southern India, Burma, Thailand, and Vietnam to and including Java, Borneo, and the Philippines.

3. **Erythrina arborescens** Roxburgh, Fl. Ind. 3: 256. 1832.

Erythrina moori Todaro, Hort. Bot. Panorm. 2: 7. *pl. 26.* 1879.

This species is composed of small to medium size trees, found at elevations between 1200 and 2100 meters. Leaves usually appear in May and fall off as soon as the tree has flowered in October.

Erythrina arborescens is found in India, Nepal, Burma, and China. In China it is the only species which is largely found to the north of the Tropic of Cancer (Sikang, Szechwan, Kweichow, and Yunnan).

In my previous paper (l.c.) I reported: "A doubtful species *Erythrina moori* was described on the basis of a cultivated plant of unknown origin and said probably to be from India. Examination of the original description and the plate establishes definitely the fact that it is an Asiatic rather than an American or African species. Examination of the type, if it exists, is necessary to check my conclusion that *Erythrina moori* is probably conspecific with *E. arborescens*."

Since that time I have become familiar with all known Asiatic and African species and there is no doubt in my mind that *E. moori* is a synonym of *E. arborescens*. The connate keel petals about 2 1/2 times longer than the wings, the ligneous pods with black seeds as shown on the excellent plate, are sufficient to establish its identity. In fact the black seeds are otherwise found only in three unrelated species of American *Leptorhizae*.

4. **Erythrina suberosa** Roxburgh, Fl. Ind. 3: 253. 1832.

This is a large deciduous tree confined to India (northern, central and southern), Nepal, Bhutan, Burma, Thailand, and Vietnam, ascending to 900 meters.

Without field studies and without seeing specimens in herbaria in India, it is not possible to decide whether *Erythrina glabrescens* (Prain) R. N. Parker (Indian Forester **46**: 647. 1920) should be placed in synonymy here or retained as a variety.

5. **Erythrina microcarpa** Koorders & Valeton, Booms. van Java 2: 61. 1895.

Erythrina stipitata Merrill, Philip. Jour. Sci. Bot. **5**: 112. 1910.

Erythrina microcarpa is a large tree, to 18 meters high, found in east Java along and near beaches on low elevations up to 900 meters.

Java: *Koorders Herbarium 46* (lvs) (L), *49* (lvs, flrs) (L), *50* (lvs) (L), *51* (lvs) (L), *65* (lvs, flrs) (K, L), *66* (lvs, flrs, frts, seeds) (K, L-lectotype), *71* (flrs) (L), *72* (lvs, flrs, frts, seeds) (K, L), *12785* (lvs, imm. flrs) (L), *14598* (flrs, imm. frts) (K, L), *14599* (lvs, flrs, imm. frts) (L); *Herb. Hort. Bot. Bogor 9620* (mixed coll., lvs-*E. subumbrans*, flrs-*E. microcarpa* (K, L); *coll. undesign. II/0–16* (1/VIII) (lvs, flrs, frts, seeds) (L); *Proefstation Java 837* (flrs) (L), *879* (flrs, frts) (L). **Philippines:** Lubang Island, near the town of Lubang, in open lands at sea level, *E. D. Merrill 958* (NY-isotype of *E. stipitata*); *s.n.* (lvs, flrs, frts) (K) with a note on the label "found without a ticket"; on the same sheet is mounted *A. D. Elmer 7132* (Jan. 1906) (lvs, flrs) from Island Leyte, prov. Leyte, loc. Palo — which is plainly *E. subumbrans*.

In the protologue of the species, Koorders & Valeton did not designate the type. It is proposed here to designate *Koorders Herb. 66* (L) as lectotype.

Examination of the two collections from the Philippines shows clearly that *E. stipitata* is conspecific with *Erythrina microcarpa*.

It will be noted that abundant material of the species from Java was distributed by S. H. Koorders in Europe only to Leiden and Kew; also that apparently only two sheets of *E. microcarpa* from the Philippines are available, as far as European and American herbaria are concerned. In the preparation of this paper I did not consult Asiatic herbaria.

The species is related to *Erythrina suberosa* and its relatives.

6. **Erythrina stricta** Roxburgh, Fl. Ind. 3: 251. 1832.

This species is a large deciduous tree usually aphyllous at anthesis. It is very spiny even in the context of its genus. The spines are white, a unique feature in the entire genus.

Erythrina stricta is found in India (northern, central and southern), Nepal, Burma, Thailand (where it is common in deciduous forests), Vietnam and China (eastern Tibet, southern Yunnan, and Kwangsi).

7. **Erythrina resupinata** Roxburgh, Fl. Ind. 3: 257. 1832.

This is an herb with a perennial thickened root which is in flower in April, at which time no part of the plant is visible but the raceme; the stem is formed later and is from 10 to 13 centimeters high.

This species is endemic to northern India.

Fruits and seeds of *Erythrina resupinata* were not seen by me in 1939. As is the case with the related species (namely *E. suberosa*, *E. microcarpa*, and also *E. stricta*), pods of it are follicular, chartaceous, not at all or slightly constricted between seeds, which are isabelline to dark brown or sooty. Seeds of the four species just mentioned are very similar. Those of *E. resupinata* are probably the smallest (8 mm. long and 6 mm. broad), followed by *E. microcarpa*; those of *E. suberosa* and *E. stricta* are larger, often 11 mm. long and 7 mm. broad.

Erythrina resupinata is very poorly represented in American and European herbaria.

Four American species of *Erythrina* (namely *E. leptorhiza* DC., *E. horrida* DC., and *E. montana* Rose & Standley confined to the higher elevations in Mexico, and *E. herbacea* L., as it occurs in the northern part of its range in the U.S.A.), as well as three species from Southwest Africa (*E. baumii* Harms, *E. mendesii* Torre and *E. pygmaea* Torre), although they are not related, are also herbaceous plants with thickened roots. Up to now no one appears to have studied the thickened roots of these species chemically. Such studies probably will prove to be of considerable interest.

This plant will likely be an excellent addition to rock gardens.

8. **Erythrina variegata** L. Herb. Amboin. 10. 1754; Amoen. Acad. 4: 122. 1759, based on *Gelala alba* Rumphius, Herb. Amboin. 2: 234, *t.* 77. 1750.

Erythrina corallodendrum L. var. *orientalis* L. Sp. Pl. 706. 1753, typified by *Mouricou* (Rheede, Hort. Malab. **6:** 13. *t. 7.* 1686). In the second edition of the *Species Plantarum* Linnaeus identified Rumphius's *Gelala litorea* Rumph. **2:** 230. *t. 76.* with Rheede's plant and cited it in synonymy.
Tetradapa javanorum Osbeck, Dagbock Ostind. Resa 93. 1757.
Erythrina picta L. Sp. Pl. ed. 2. 993. 1763, based on *Gelala alba* Rumphius Herb. Amboin. **2:** 234. *t. 77.* 1750.
Erythrina orientalis (L.) Murr. Comm. Götting. **8:** 35. *t. 1.* 1787.
Erythrina indica Lamarck, Encycl. **2:** 391. 1788.
Erythrina corallodendrum Loureiro, Fl. Cochinchinensis 427. 1790.
Erythrina spathacea DeCandolle, Prodr. **2:** 412. 1825.
Erythrina divaricata DeCandolle, *Ibid.* 414.
Erythrina lithosperma Blume, Cat. Gew. Buitenzorg 92. 1823 (nomen nudum); Hasskarl, Flora **25.** Beibl. II. 77. 1825, descr. and Pl. Jav. Rar. 381. 1848 (not *E. lithosperma* Miquel, Fl. Ind. Bat. **1:** 209. 1855).
Erythrina loureiri G. Don, Gen. Syst. **2:** 372. 1832 (based on *E. corallodendrum* Loureiro).
Erythrina carnea Blanco, Fl. Filip. 564. 1837; ed. 2. 393. 1845; ed. 3. **2:** 359. *t. 217.* 1879; not *E. carnea* Ait. Hort. Kew. **3:** 8. 1789.
Chirocalyx indicus (Lamarck) Walpers, Flora **36:** 148. 1853.
Chirocalyx pictus (L.) Walpers, *Ibid.*
Chirocalyx candolleanus Walpers, *Ibid.*
Chirocalyx divaricatus (DeCandolle) Walpers, *Ibid.*
Erythrina parcellii Bull, Gard. Chron. n.s. 1874 (II): 392, *fig. 82.* 1874.
Erythrina alba Cogniaux & Marchal, Plantes à feuillage ornamental **2:** *pl. 56.* 1874.
Erythrina marmorata Veitch ex Planchon, Fl. des Serres **23:** 21 (*pl. s.n.*). 1880.
Corallodendron divaricatum (DeCandolle) Kuntze, Rev. Gen. Pl. **1:** 172. 1891.
Corallodendron spathaceum (DeCandolle) Kuntze, *Ibid.* 173. 1891.
Corallodendron orientale (L.) Kuntze, *Ibid.* 172. 1891.
Erythrina phlebocarpa F. M. Bailey, Queensl. Agr. Jour. **1:** 368. 1897.
Erythrina variegata L. var. *orientalis* (L.) Merrill, Interp. Herb. Amboin. 276. 1917, and in Trans. Am. Phil. Soc. **24:** 208. 1935, based on *Erythrina corallodendrum* L. var. *orientalis* L. Sp. Pl. 706. 1753.
Erythrina mysorensis Gamble, Kew Bull. **1919:** 222. 1919.
Erythrina rostrata Ridley, Flora Malay Penins. **1:** 580. 1922.
Erythrina indica Lamarck var. *alba* Blatt. & Mill. in Jour. Bombay Nat. Hist. Soc. **33:** 628. 1929.
Erythrina boninensis Tuyama, Bot. Mag. Tokyo **49:** 373. 1935.
Erythrina variegata L. var. *orientalis* (L.) Merrill, forma *picta* (L.) Maheshwari, Bull. Bot. Surv. India **3:** 47. 1961.
Erythrina variegata L. var. *orientalis* (L.) Merrill, forma *parcellii* (Hort. ex Bull) Maheshwari, *Ibid.*
Erythrina variegata L. var. *orientalis* (L.) Merrill, forma *marmorata* (Hort. ex Veitch) Maheshwari, *Ibid.*
Erythrina variegata L. var. *orientalis* (L.) Merrill, forma *mysorensis* (Gamble) Maheshwari, *Ibid.*
Erythrina variegata L. var. *orientalis* (L.) Merrill, forma *orientalis* (L.) Maheshwari, *Ibid.* 48.
Erythrina variegata L. var. *orientalis* (L.) forma *alba* (Blatt. & Mill.) Maheshwari, *Ibid.*

Erythrina variegata L., *E. corallodendrum* L. var. *orientalis* L., and *E. picta* L. were based on plants from Herb. Amboin.; the type of *Tetradapa javanorum* is from Java; that of *E. carnea* Blanco from the Philippines; that of *E. corallodendrum* Loureiro from Vietnam; that of *E. indica* from India; that of *E. spathacea* from Santo Domingo. *E. divaricata* was based on a Sessé & Moçiño plate and was said to be a Mexican plant, but was doubtless drawn from a cultivated plant, probably collected in the West Indies. The type of *E. lithosperma* is from the Botanic Gardens, Bogor, Java; that of *E. parcellii* and of *E. alba* a cultivated (?) plant "from South Sea Island"; that of *E. marmorata* a plant of unknown origin "des îles de la mer du Sud"; that of *E. phlebocarpa* a plant cultivated in New South Wales, Australia; that of *E. mysorensis* from Mysore, South India; that of *E. rostrata* from Kedah, Malaya; and that of *E. boninensis* from the Island of Bonin.

DISTRIBUTION. Specimens were seen from the following countries: Tanzania (Tanganyika: Dar es Salaam & Mafia Island, Zanzibar), Madagascar, Maldive Islands, Ceylon, India (west Bengal, Mysore, Madras), Burma, Andamans, Thailand, Cambodia, Laos, Vietnam, China (Yunnan, Kwangtung, Hainan), Hongkong, Formosa, Ryukyu Islands, Malaya, Sumatra, Java, Timor, Borneo, Philippines, Celebes, Moluccas, New Guinea, New Britain, Solomon Islands, New Caledonia, New Hebrides, Fiji, Samoa, Tonga, Marianas, Carolines, Society Islands, Tahiti, and the Marquesas.

HABIT and HABITAT. This species is a large tree of the lowlands, being especially common along the sea coasts. It is now widely cultivated in the tropics; it was an early introduction to the New World and was even described twice as a new species, native to America, by DeCandolle.

In my previous paper (l.c.) I accepted the name *E. variegata* L. var. *orientalis* (L.) Merrill for this species, as suggested by E. D. Merrill. However, the arguments of A. A. Bullock (Kew Bull. 20: 294. 1966) are convincing and I now accept *Erythrina variegata* L. as the valid name for the species.

Erythrina parcellii and *E. alba* are obviously a form of the species with variegated leaves; I examined the specimen at Kew on which they were based.

The basis of *E. marmorata* is a sterile specimen of uncertain origin collected "des îles de la mer du Sud." It is obviously a horticultural form of the species with variegated (white-spotted) leaves.

Reexamination of the type-material of *E. phlebocarpa*, now mounted on three sheets (BRI) carefully annotated by S. T. Blake, shows that the protologue of this species was derived from elements of two species. The fruiting element (BRI 007963) represents *E. variegata* L., but the leaves associated with the pod by Bailey represent an African species, *E. lysistemon* Hutchinson. No flowers survive with the type-series as preserved at Brisbane, but the ostensible cotype at Kew has flowers of *E. variegata* mounted with foliage of *E. lysistemon*, whereas that at the British Mu-

seum (Nat. Hist.) has flowers and one pod of *E. variegata* mounted with leaves of *E. lysistemon*. In order to settle the synonymy, it is proposed here to designate the fruiting element, that part of the mixture which suggested the epithet *phlebocarpa* (BRI 007963), as lectotype. The name then falls into the synonymy of *E. variegata*.

It should be noticed that the flowers preserved at the British Museum and Kew cannot in any circumstances be considered part of the type-series for they disagree seriously with the original description. Bailey described the calyx of *Erythrina phlebocarpa* as "campanulate, oblique at the top," whereas the calyx of *E. variegata* is spathaceous, deeply split ventrally. It seems likely, therefore, that Bailey actually saw and described flowers of *E. lysistemon*, the species to which belong the leaves preserved at Brisbane, and that the flowers associated with leaves of *E. lysistemon* in the English herbaria were added as an afterthought, none of them, interestingly enough, being retained in Australia. My remarks on *E. phlebocarpa* (1939, p. 233) were based on study of the flowerless plants with associated pod and seeds now at Brisbane and flowers of an *Erythrina*, now recognized as the African *E. lysistemon*, which is extensively cultivated in Australian gardens.

The following material of the type collection of *E. phlebocarpa* was examined:

Australia. NEW SOUTH WALES: *Queensland Herb. 007961, 007962, 007963* (3 sheets deposited at Queensland Herbarium) (type coll. of *E. phlebocarpa*, lvs of *E. lysistemon* Hutchinson, and frts and seeds of *E. variegata* L.), the Kew sheet of the same collection consists of leaves of *E. lysistemon* and flowers of *E. variegata* L., whereas the British Museum sheet consists of leaves of *E. lysistemon* and one fruit and flowers of *E. variegata* L.

The following material of *E. lysistemon* from Australia was examined:

NEW SOUTH WALES: *Sabine Helms 1447* (flrs & mature lvs) (cult.) (US), *F. A. Rodway 813* (flrs) (Nowra, extensively planted in district, does not form fruit in this district — flowers fall as soon as they begin to grow) (K), *813A* (mature lvs) (K), *Kaspiev 396* (flrs) (G), *1308, 1318* (flrs) (Z).

QUEENSLAND: *C. T. White 9073* (flrs & mature lvs) (cult. Brisbane Bot. Gard.), *Brass 33486* (flrs & mature lvs) (Bromfield Crater, Atherton Tableland) (K), *Kaspiev 883* (flrs) (Z).

LORD HOWE ISLAND: *M. M. J. v. Balgooy 1109* (L) (flrs) (treelet c. 2 m., landslide of sand dune).

New Zealand. AUCKLAND: *W. R. Sykes 703/64* (flrs & young lvs, 30/9–1964) (Parnell Rose Garden) (CAS), *787/64* (flrs & young lvs, 2/10–1964) (Mt. Albert, exposed bank) (CAS), *697/64* (flrs & mature lvs, 29/9–1964) (Auckland Domain) (CAS), *700/64* (fl 30/9–1964) (Parnell Rose Garden) (CAS), *812/64* (frts, seeds & mature lvs, 3/10–1964) (Garden) (CAS); *Schweinfurth 1075* (flrs & lvs) (North Island, North Auckland) (M).

According to W. R. Sykes this species is known in cultivation in New Zealand as "*Erythrina indica* Lam." Seeds on his specimen are typical of *E. lysistemon* with black hilum.

On the basis of the original description of *Erythrina mysorensis* ("calyx spathaceous. . . . carinae petalae liberae") I suggested in my previous paper (l.c.) that *E. mysorensis* might be merely a related variety or a form of the common and widespread *E. variegata*.

In my previous paper (l.c.), I suggested that the doubtful *E. rostrata* may prove to be a synonym of the species. With the help of B. Verdcourt, I recently located the isotype of this species at Kew (*Ridley 15782*, April, 1890, from Kedah, Pulau Adang Seashore, Malaya). The specimen consists of young and mature leaves, 3 pods, and seeds. It manifestly belongs with the species.

I have examined the holotype of *E. boninensis* (*Takasi Tuyama s.n.* (TI) April 14, 1934, from the Island of Bonin, Chichijima, Omura). It consists of the upper portions of 4 rachises with flowers and a considerable number of loose flowers in poor condition. The flowers are rather small for the species but obviously belong here. I also examined 2 other sterile collections of *Erythrina* from Bonin *H. Hattori s.n.* (2/8–1905) (TI) and *Takasi Tuyama s.n.* (Dec. 24, 1968). They also are obviously of this species.

There seems to be no need to distinguish as species different forms of *Erythrina variegata*, and there is no justification for separation at the varietal level of *Gelala alba* Rumphius and *Gelala litorea* Rumphius. As early as 1917 Merrill stated: "Strictly, the specific name *variegata* should be adopted to include not only the form with the variegated leaves, but also the much commoner and widely distributed form with uniformly green leaves." It should be kept in mind, too, that forms with white flowers and/or variegated leaves occur also in other species (*E. berteroana*, *E. falcata*, and others).

Inasmuch as various species of *Erythrina* (especially *E. crista-galli* L., *E. lysistemon* Hutchinson, and *E. variegata* L.) were cultivated in greenhouses or in the open in Europe and the U.S., as well as on other continents for many years, there are many horticultural forms, some of which are referred to in the literature. I mentioned some of the horticultural forms of *E. crista-galli* in my monograph of the American species (Brittonia 3: 231. 1939).

C. A. Backer in 1911 (Schoolflora voor Java 1: 360) and then C. A. Backer & R. C. Bakhuizen van den Brink, Jr., in 1963 (Flora of Java, 1: 628) suggested that *Erythrina crassifolia* is probably a hybrid between what is now known as *E. variegata* and *E. subumbrans*. In the second publication, they give a rather complete description of *E. crassifolia*. It is cultivated locally in Java, its pods are usually poorly developed, and seeds are deformed or quite abortive, which is usually the case with *Erythrina* hybrids. I accept the suggestion that *E. crassifolia* is a hybrid without reservation, but I suggest that it is probably a hybrid between *E. variegata* and *E. fusca* (see for example *S. M. Popta 00527/96* (L) which has leaves closely resembling those of the latter species. Among other specimens of *E. crassifolia* I have examined *Koord. Herb. 76* (L) and *Herb. Hort. Bot. Bog. Kds. 32440* (L) marked as "n. sp." by Koorders.

9. **Erythrina tahitensis** Nadeau, Enum. Pl. Tahiti 80. 1873.

Erythrina sandwicensis Degener, Fl. Hawaii. 2: Fam. 169c. 1932.

This is a large tree, often found on arid rocky grounds including lava flows.

The species is found in Tahiti and Hawaii.

In a previous paper (l.c.) I stated: "I have seen *Nadeau 499* (type of *E. tahitensis*) deposited at Geneva. It consists of a single inflorescence with small flower buds, two flowers, one pod, one seed and no leaflets. From this available material it is impossible to decide whether or not this plant is specifically distinct from the plant native to Hawaii."

Recently I examined in Paris two additional sheets of this species, as it is represented in Tahiti. The holotype (*Nadeau 499*) consists of a fruiting inflorescence with 3 pods and seed, also one flowering inflorescence with immature flowers. Another collection (*M. Pancher 801* (1860), "sur montagne élevée des Tahiti) consists of a branchlet with two mature leaves and one immature, one flowering inflorescence, also one pod, and one flower in good condition. It is the basis of the name *E. montana* Forst. (Cuzent, G., Iles Tahiti 230. 1860).

I concluded that the Hawaiian plant is conspecific with the plant from Tahiti.

It was suggested that the plant is probably extinct in Tahiti. However, taking into account its habitat, this seems to be most unlikely. The type collection is from "precipicie, de Tâutana, 800 m"; for the habitat of the Pancher collection see above. Recently Brother Alain told me of his unsuccessful attempt to collect the very rare *E. buchii* Urban in the Dominican Republic where he saw it in flower on a precipice inaccessible without special climbing equipment. *E. tahitensis* is in flower in Tahiti in August, when collection is easier, as its striking orange flowers are visible at considerable distances. The native name for this species in Tahiti is "atae oviri."

10. **Erythrina euodiphylla** Hasskarl, Hort. Bogor. 178. 1858.

This is a large tree of the lowlands, including savannas with high grasses and scattered trees and shrubs.

It is endemic to eastern Java and neighboring Madura and Bali.

This species is represented in herbaria of Europe and U.S.A. only by the two specimens cited below:

Eastern Java: *M. Jacobs 4886* (L), *H. Zollinger 1440* (G).

This species is unique in the genus, having all petals green and leaves fetid when fading. The species is immediately distinguished from *Erythrina fusca*, *E. macrocarpa*, and *E. subumbrans* which also occur in Java, as its rachises, pedicels, and leaflets (at least on petiolules and costa beneath when young) are stellate pubescent. The only other species which is found in Java, *E. variegata*, is distinguished by the prominent veining on the pod and standards. The species is related to *E. stricta*.

I have not seen fruits and seeds of *Erythrina euodiphylla* as they are not available in European and America herbaria. However, immature fruit and seeds were described by Hasskarl.

11. **Erythrina merrilliana** Krukoff, Jour. Arnold Arb. 20: 227. 1939.

This is a striking tree with bright orange flowers which reaches the canopy in the rain forest on low elevations up to ± 1200 meters. Trees up to 24 meters high are recorded.

The species is endemic to New Guinea.

Since this species was described in 1939, seven additional collections were examined by me.

New Guinea. CENTRAL DISTRICT: *L. J. Brass 5265* (Mafubu, elev. ± 640 m.) (BM, NY-holotype), *Darbyshire 843* (Kairuku subdistrict, ± 5 1/2 km. north of Ikikina village) (L), *R. Schodde 2491* (near Karema, Brown River, elev. 30 m.) (G, K, L), *2642* (near southwest base of Mt. Lawes, elev. 30 m.) (G, L); MOROBE DISTRICT: *McVeigh & N. G. F. Ridgwell 7336* (Bulolo Valley, elev. 900 m.) (L), *B. Blackwood 270* (elev. 1200 m.) (K); MILNE BAY DISTRICT: *L. J. Brass 24251* (elev. ± 64 m.) (G, L). PAPUA: *C. E. Carr 12835* (Rouna) (BM).

Mature seeds were not seen at the time the species was described. Seeds are scarlet with black hilum 9 to 10 mm. long and 6 to 7 mm. broad and have a black line extending from the hilum for approximately 2 mm. toward the chalazal end. They are unlike those of any other Asiatic-Polynesian species but are indistinguishable from those of the Australian *Erythrina insularis*. Seeds of *E. merrilliana* resemble those of many African species (including *E. abyssinica* Lamarck) in being scarlet with a black hilum, and those of many American ones (including *E. berteroana* Urban) in having a black line extending from hilum about 2 mm. toward the chalazal end, although in none of the latter is the hilum itself black.

Beside *Erythrina merrilliana* two species have been recorded from New Guinea: *E. fusca* Loureiro and *E. variegata* L. The former has connate keel petals, a long-stipitate standard, and campanulate calyx; from the latter *E. merrilliana* is distinguished by its bright orange flowers and elliptic-oblong standard without prominent veining. This species is related to *E. tahitensis*. It is immediately distinguished, however, by the small seeds and by the calyx which in the part opposite the cleft has five long (up to 5 mm.) spurlike teeth, resembling in this character again certain African species.

12. **Erythrina insularis** F. M. Bailey, Queensl. Agr. Jour. 1: 228. 1897.

This is said to be a spreading tree about 4.5 to 6.5 meters high. It is known only from the type collection.

Australia. QUEENSLAND. Turtle Island: *F. M. Bailey 29* (June 1897), BRI-holotype — detached leaflets, petioles, fragments of branchlets, and a single

rachis with pods and seeds, BM — four leaflets and pods with seeds, K — three leaflets, rachis with pods and seeds (plus a pod of *E. variegata* L. mounted on the right).

This species is related to *Erythrina merrilliana*. It is stellate pubescent and its fruits and seeds are indistinguishable from those of the latter species (see under *E. merrilliana*).

13. **Erythrina vespertilio** Bentham in Mitch. Jour. Trop. Austr. 218. 1848.

This species is a short-boled tree, often from 0.3 to 0.9 meters in diameter and is rather common along the coastal areas of southern Queensland.

It is confined to tropical and subtropical Australia (Western Australia, Northern Territory, Queensland, and New South Wales).

The species shows extraordinary variations in the form of leaflets, to which Bentham (Fl. Austr. 2: 253. 1864) has already called attention. Two other species of *Erythrina* native to Africa, namely *E. livingstoniana* Baker and *E. humeana* Sprengel also show extraordinary variations in the form of the leaflets. They are not related to *E. vespertilio*.

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